

299-W15-44 (C3956) Log Data Report

Borehole Information:

Borehole: 299-W15-44 (C3956)		Site: Near SW corner of TY Farm			
Coordinates (WA State Plane)		GWL (ft)¹: 234.0	GWL Date: 10/17/2002		
North Unknown	East Unknown	Drill Date Oct. 2000	TOC² Elevation Unknown	Total Depth (ft) 340.4	Type Becker

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	0.0	11.75	10.75	0.50	0.0	34.5
Threaded Steel	2.7	9.00	8.00	0.50	+2.7	341.26
Threaded Steel	3.0	6.25	6.00	0.125	+3.0	341.26
The driller was the source for the casing depth and stickup information.						

Borehole Notes:

Well construction information, as shown in the above tables, is from measurements by the driller and Stoller field personnel. Zero reference is the ground surface. The logging engineer measured the outside and inside casing diameters of the 6-in. and 11-in. casings using a steel tape and calipers. The outside diameter of the 9-in. casing was measured with calipers and a steel tape. The inside diameter and thickness of the 9-in. casing were estimated. The Becker drilling system utilizes a special dual-wall casing string. Air passes through the annular space between the inner and outer casings, and rill cuttings are brought up inside the inner casing. For this well, the casing consisted of a 6-in. ID inner casing with 0.125-in. wall thickness inside an 8-in. ID outer casing with 0.5-in. wall thickness. The inner casing is thicker at casing joints, where wall thickness is 0.406 in. Casing joints are approximately 1 ft long overall and occur at 10-ft intervals. No contamination was detected during drilling.

Logging Equipment Information:

Logging System: Gamma 3E (RLS-1)	Type: 70% HPGe
Calibration Date: 10/2002	Calibration Reference: GJO-2002-386-TAR
Logging Procedure: MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5
Date	10/17/02	10/18/02			
Logging Engineer	Pearson	Pearson			
Start Depth (ft)	0.0	341.0			
Finish Depth (ft)	180.0	150.0			
Count Time (sec)	100	100			
Live/Real	R	R			

Log Run	1	2	3	4	5
Shield (Y/N)	None	None			
MSA Interval (ft)	1.0	1.0			
ft/min	N/A ³	N/A			
Pre-Verification	CE001CAB	CE011CAB			
Start File	CE001000	CE011000			
Finish File	CE001180	CE011191			
Post-Verification	CE001CAA	CE011CAA			
Depth Return Error (in.)	-0.5	-.25			
Comments	Fine-gain adjustments.	One fine-gain adjustment.			

Logging Operation Notes:

Zero reference was the ground surface. Logging was performed without a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (⁴⁰K, ²³⁸U, and ²³²Th) verifier with serial number 118. The interval from 180 to 150 ft is the repeat section.

Analysis Notes:

Analyst:	Sobczyk	Date:	10/29/02	Reference:	GJO-HGLP 1.6.3, Rev. 0
-----------------	---------	--------------	----------	-------------------	------------------------

RLS pre-run and post-run verification spectra were collected at the beginning and end of each day. The verification spectra were all within the control limits except for file CE001CAB. File CE001CAB was slightly below the lower control limit for the 1460 keV peak counts per second (cps). Examination of spectra indicates that the detector appears to have functioned normally during all of the logging runs, and the spectra are provisionally accepted, subject to further review and analysis. The peak counts per second at the 609- keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were generally higher and between 1 and 5 percent of one another.

Log spectra for the RLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: RLS-1Oct02.xls), using parameters determined from analysis of recent calibration data. Zero reference was the ground surface. Data were analyzed using a uniform casing correction based on the cumulative wall thickness of 0.625 in. for the dual wall casing. This correction was applied from 34.5 to 340.0 ft. From ground surface to 34.5 ft, the casing correction factor was calculated based on 1.125 in., which represents the cumulative thickness of the dual wall casing and the 10.75-in. ID surface casing. The increase in casing thickness at the joints in the dual wall casing results in an apparent reduction in concentration, because the actual thickness increases to 0.9 in., but the casing correction is not changed. Open hole was assumed at 341 ft. Where more than one casing exists at a depth, the casing correction is additive (e.g., the correction for both an 9-in. and 6-in. casing would be $0.5 + 0.125 = 0.625$). A water correction was applied to the RLS data at and below 234.0 ft. For the 70-percent HPGe detector, dead time at background count rates varies from 2 to 6 percent, averaging about 4 percent. This appears to be due to random fluctuation, as it does not correlate with count rate. Apparently, this fluctuation is an operational characteristic of the detector. Experiments with the detector in the calibration models indicate that the dead time is a function of count rate and that a dead time correction function similar to that developed for the SGLS can be used to linearize the data. Dead time values less than 10 percent should be ignored. Dead time corrections are required when dead time exceeds 18 percent. As the dead time did not exceed 18 percent, a dead time correction was not needed or applied.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K , ^{238}U , and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

Man-made radionuclides were not detected in this borehole.

Recognizable changes in the KUT and total gamma logs occurred in this borehole. Below a depth of 7 ft, apparent decreases in total gamma and KUT concentrations occur every 10 ft at the casing joints in the dual wall casing. These changes are due to an increase in gamma-ray attenuation associated with the increase in casing thickness at the joints, rather than an actual change in activity. They are most apparent on the total gamma, ^{238}U (609 keV), and ^{40}K (1461 keV) logs. Changes in apparent ^{40}K concentrations of about 5 pCi/g occur at approximately 35, 108, 120, 220, and 234 ft. The relatively low concentrations of ^{40}K above 35 ft are due to the surface casing. A 5-pCi/g decrease in ^{40}K concentrations is evident from 108 through 120 ft. ^{238}U concentrations increase by approximately 0.5 pCi/g in the intervals between 99 and 124 ft. ^{232}Th concentrations increase by at least 0.5 pCi/g or more in the intervals between 99 and 108 ft. Between 99 and 108 ft, the fine-grained member of the Cold Creek Unit (formerly known as the Early Palouse Soil) is indicated by an increase in total gamma (75 cps) and ^{232}Th (0.5 pCi/g).

The plots of the repeat logs demonstrate good repeatability of the RLS data for the natural radionuclides (609, 1461, 1764, and 2614 keV).

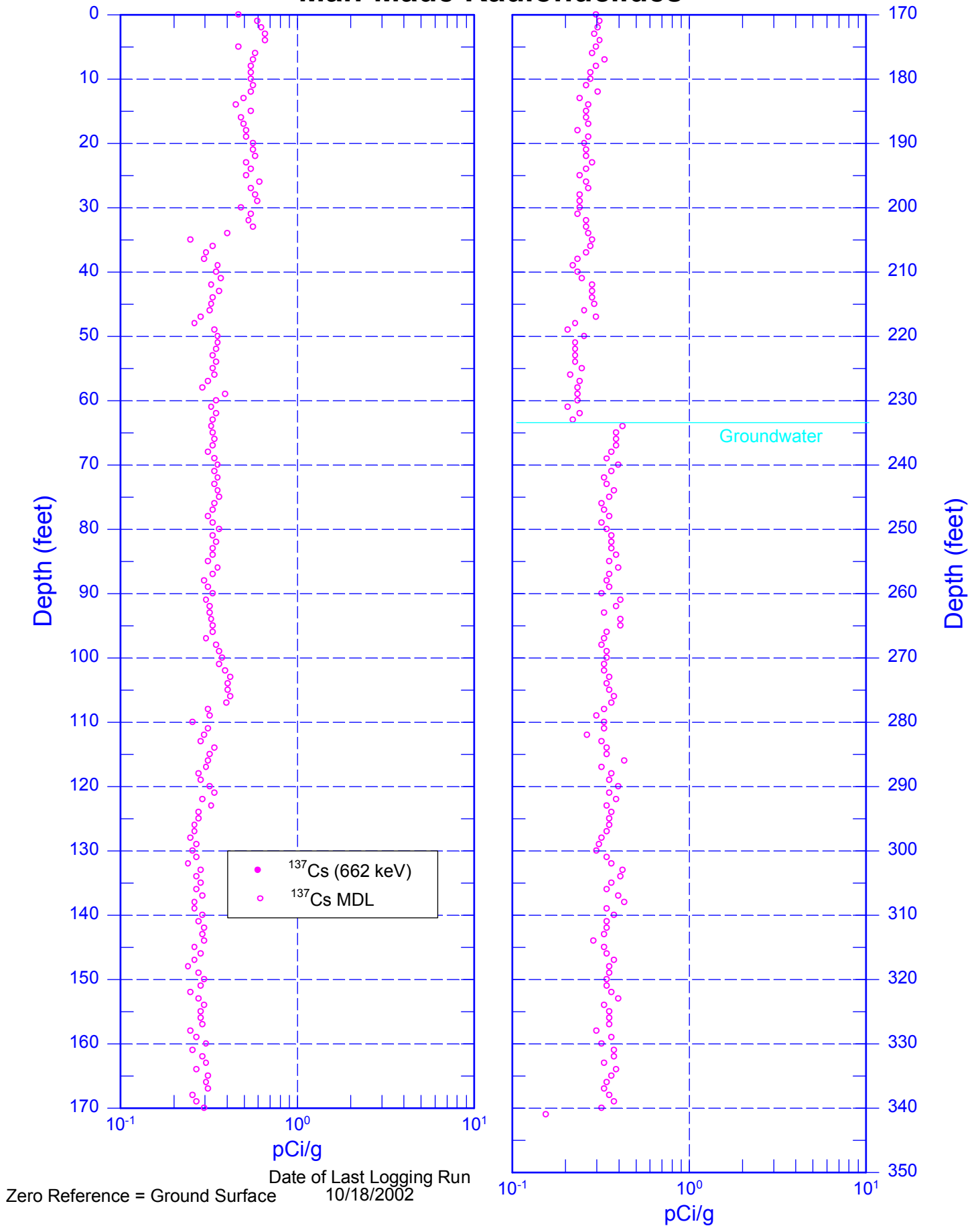
¹ GWL – groundwater level

² TOC – top of casing

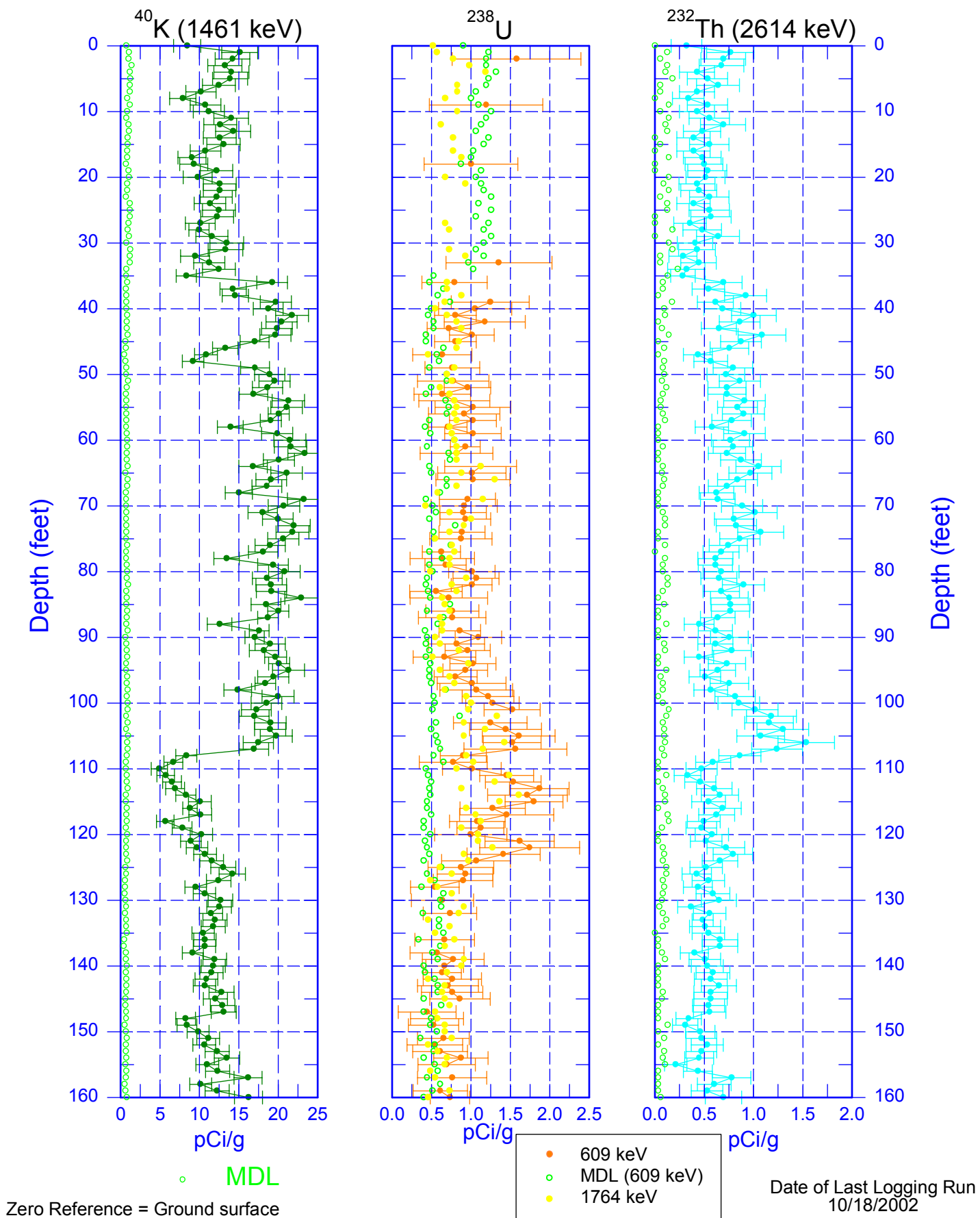
³ N/A – not applicable

299-W15-44 (C3956)

Man-Made Radionuclides

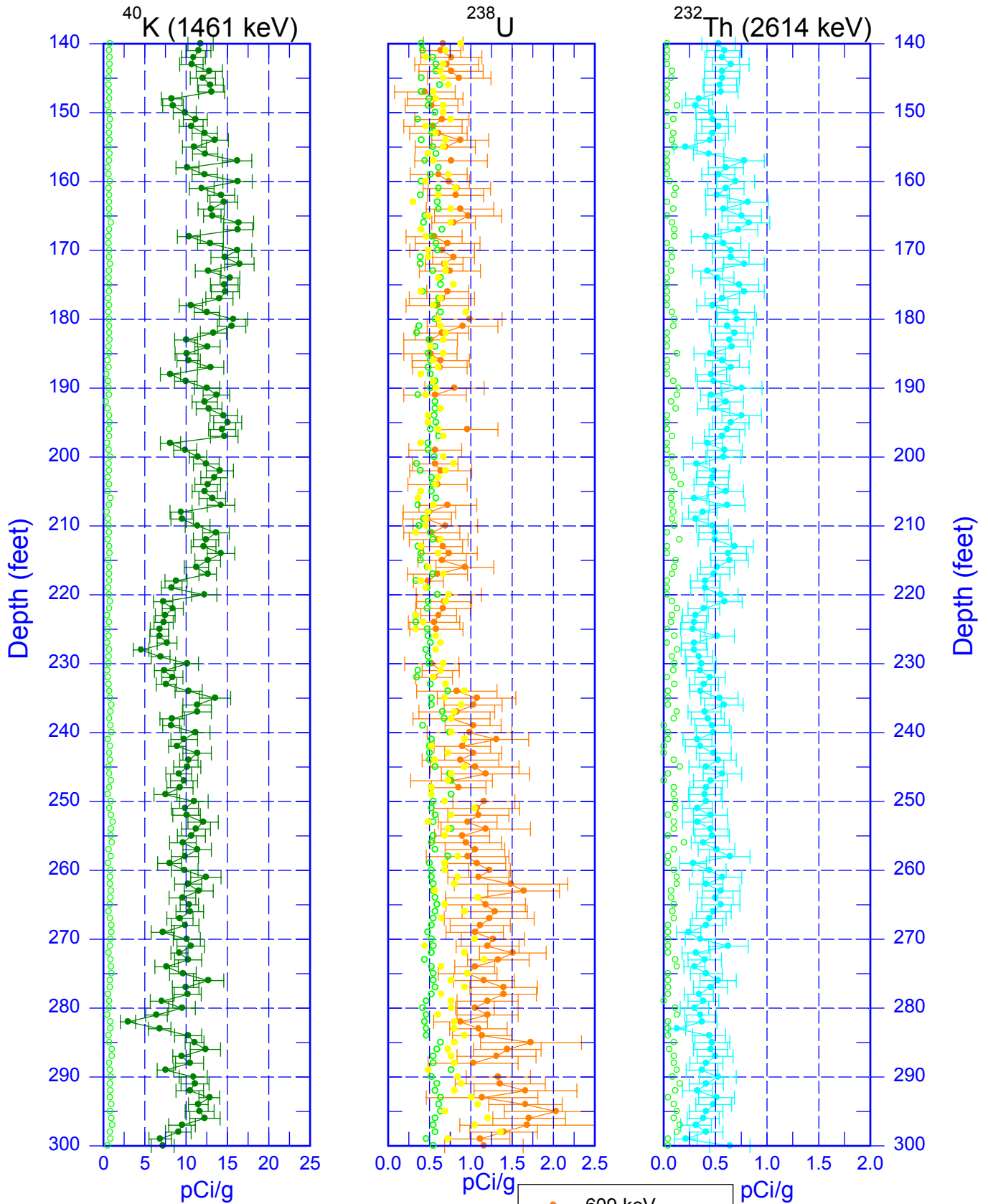


299-W15-44 (C3956) Natural Gamma Logs



299-W15-44 (C3956)

Natural Gamma Logs

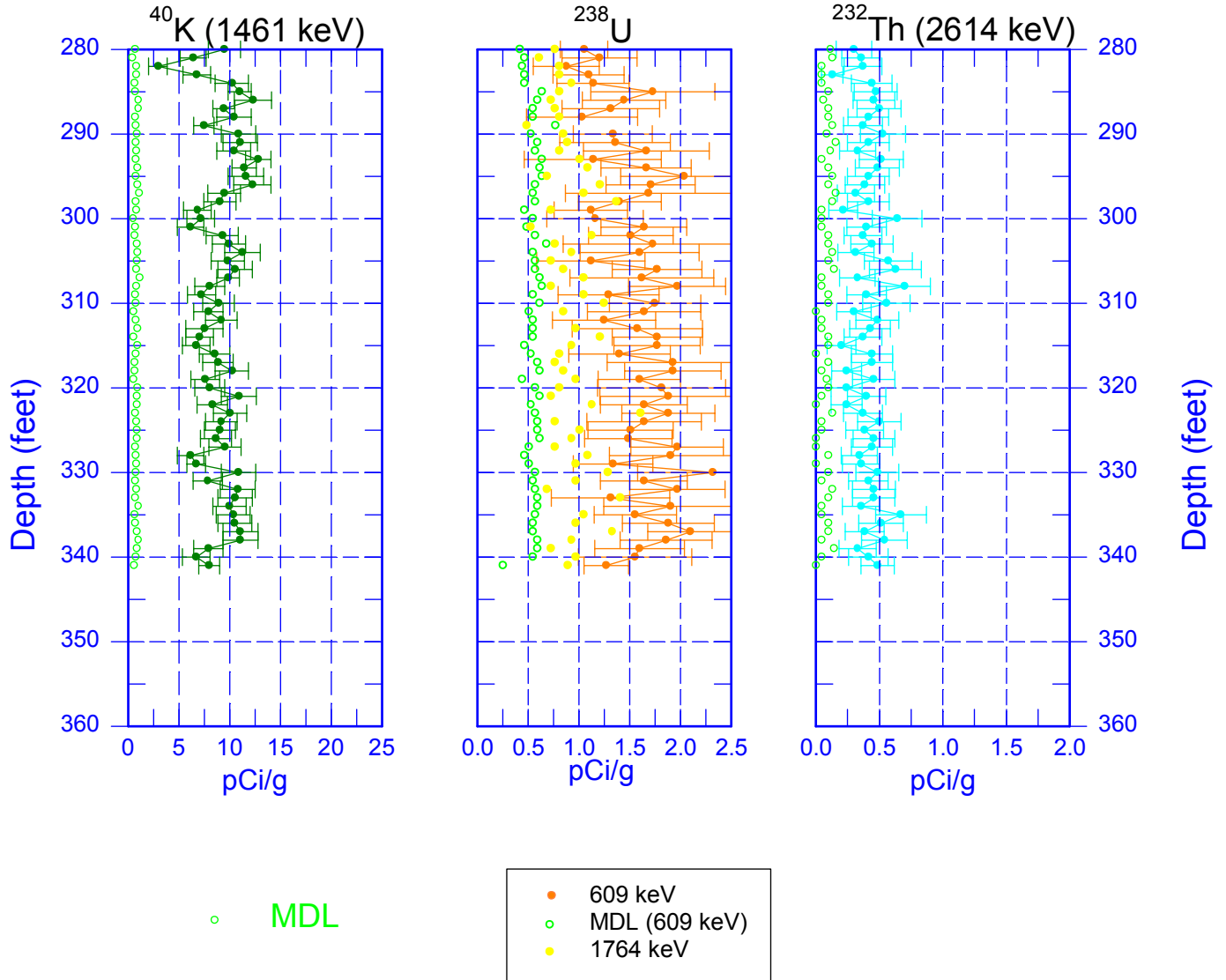


Zero Reference = Ground surface

Date of Last Logging Run
10/18/2002

299-W15-44 (C3956)

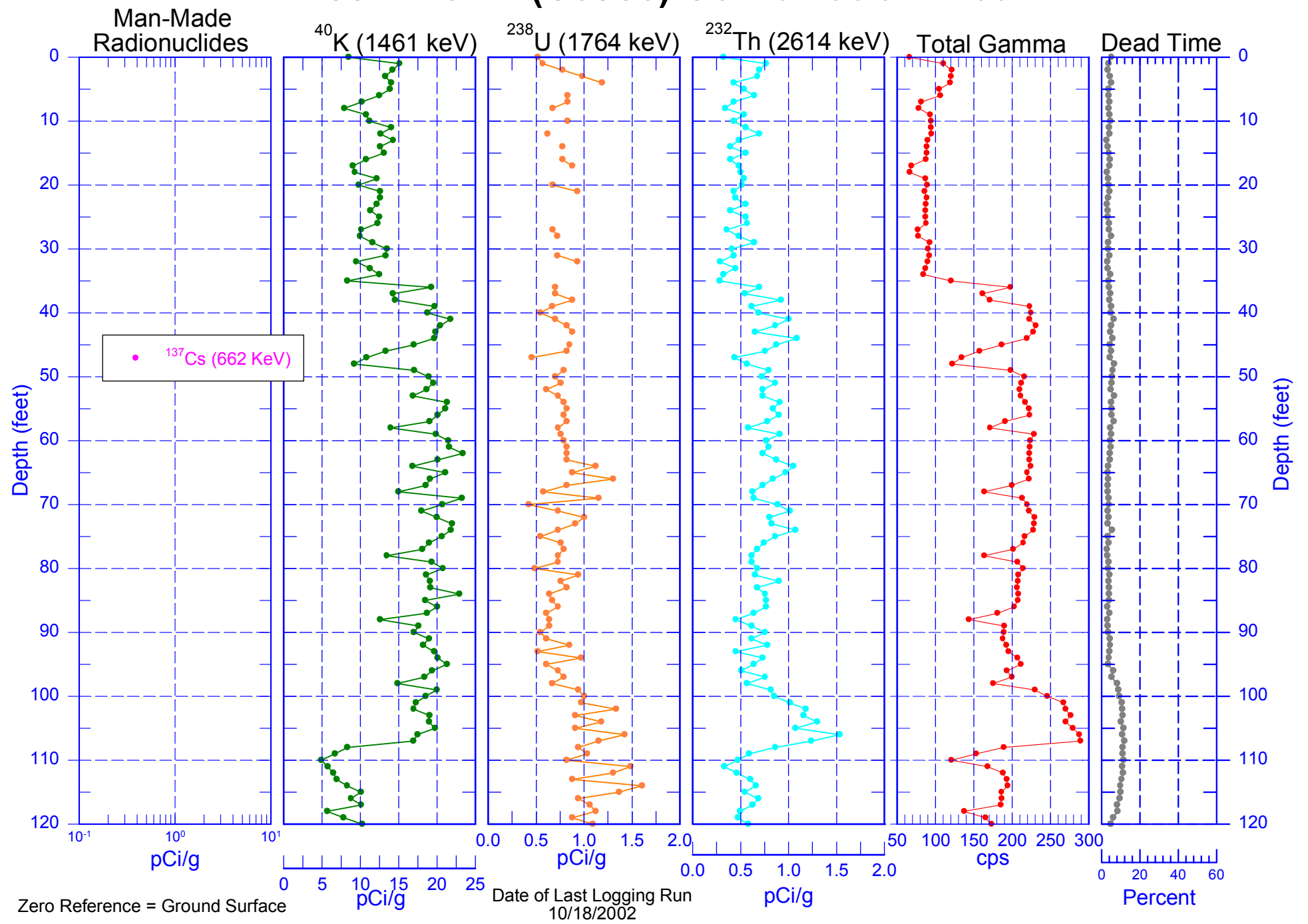
Natural Gamma Logs



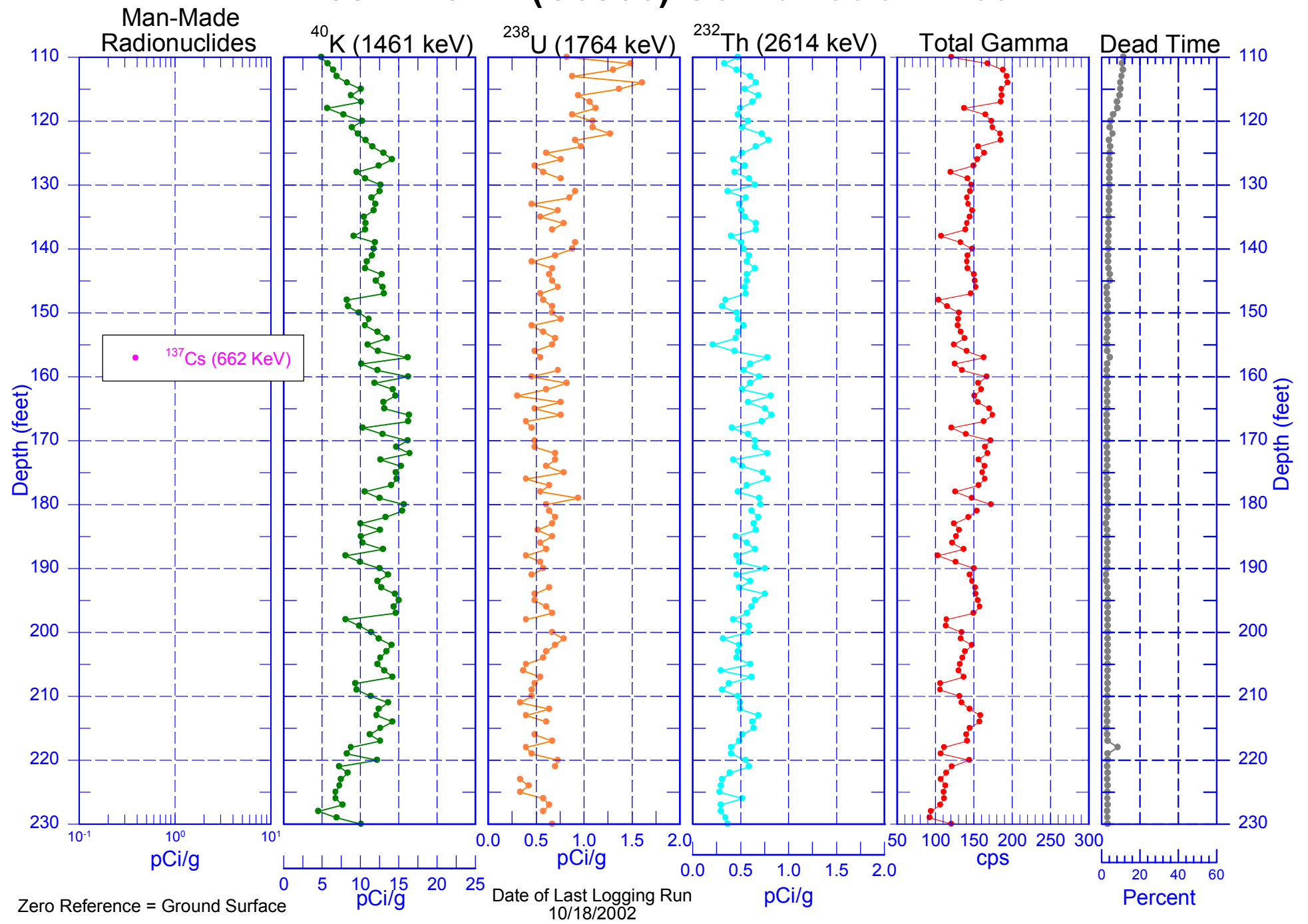
Zero Reference = Ground surface

Date of Last Logging Run
10/18/2002

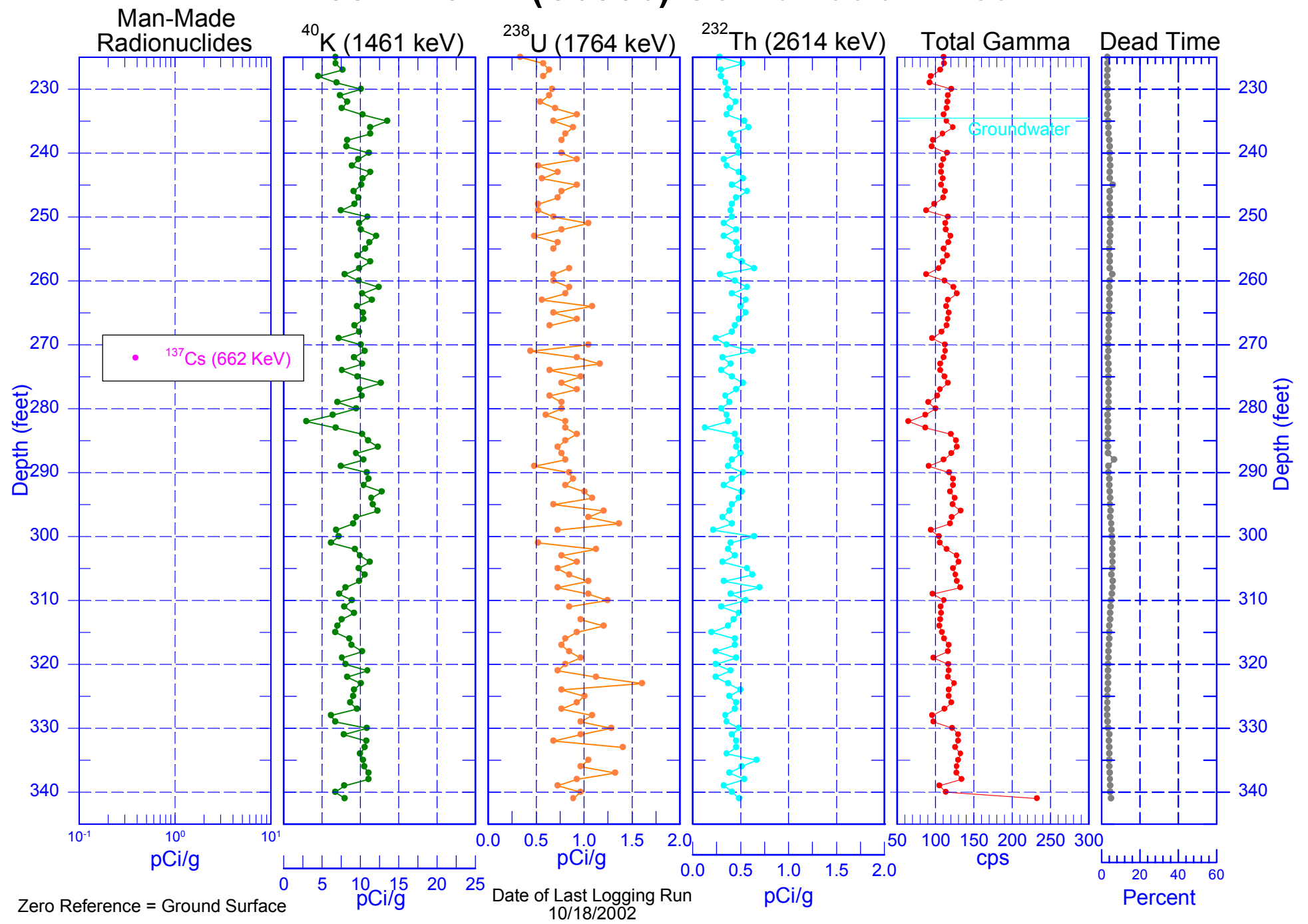
299-W15-44 (C3956) Combination Plot



299-W15-44 (C3956) Combination Plot

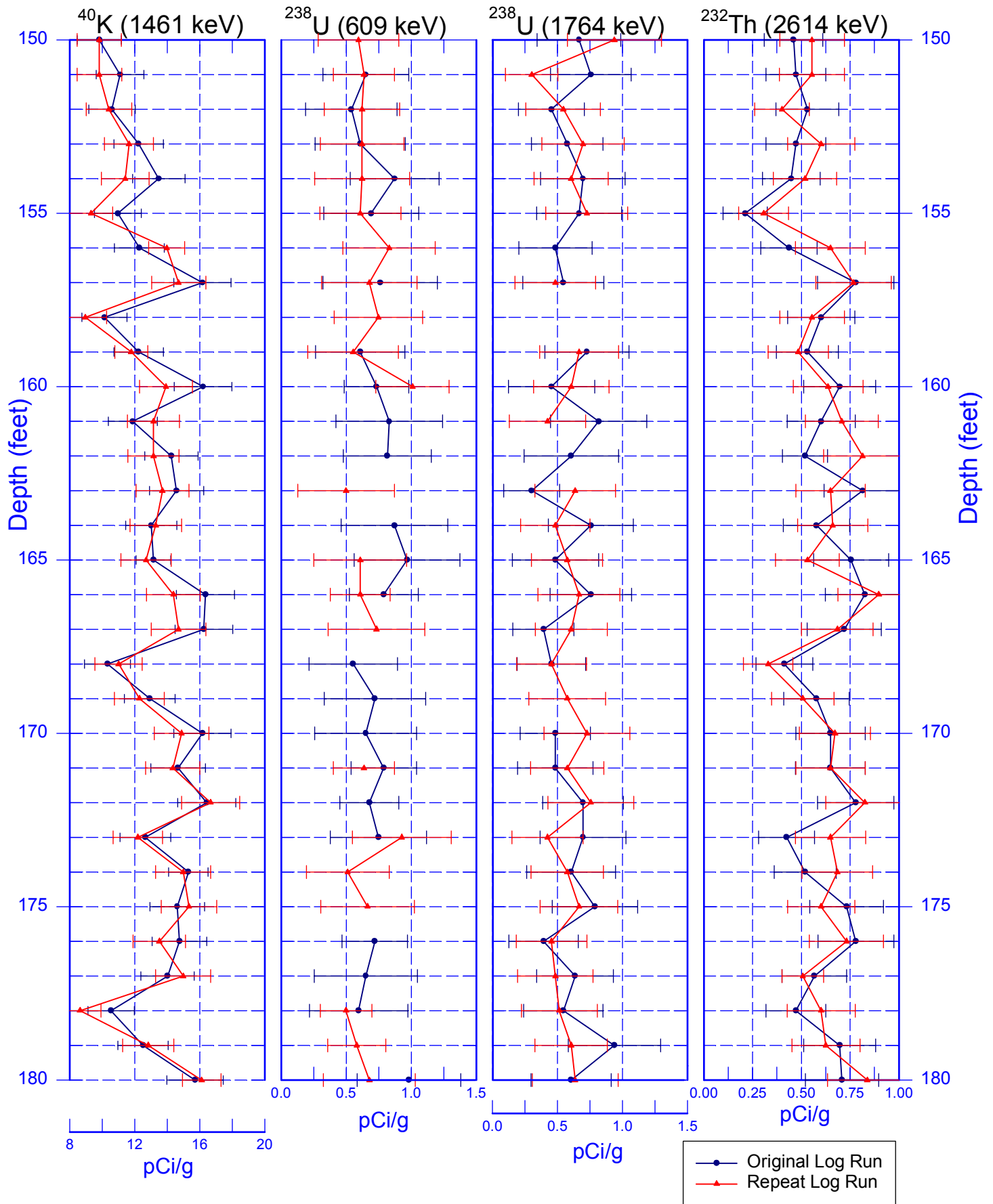


299-W15-44 (C3956) Combination Plot



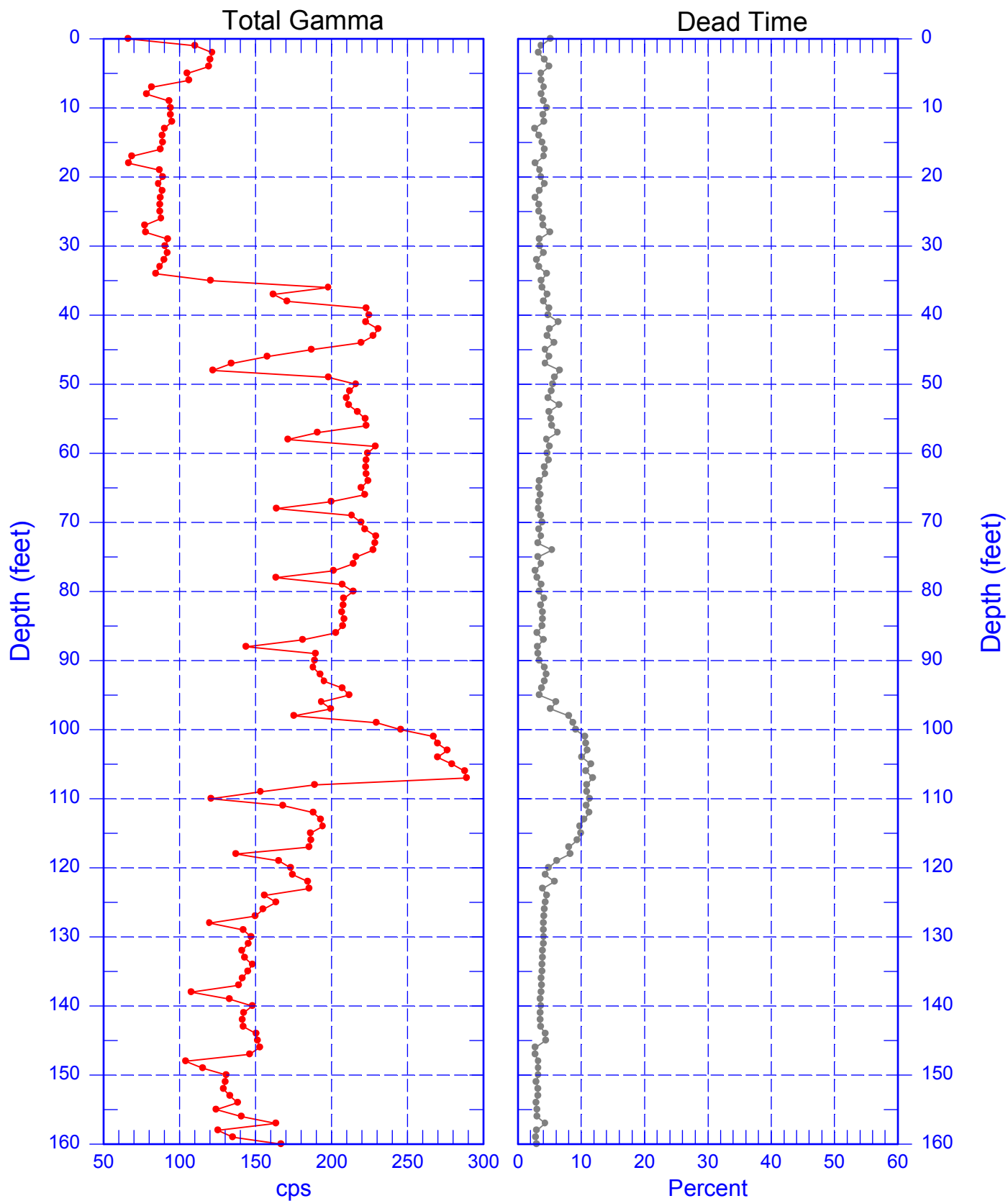
299-W15-44 (C3956)

Rerun of Natural Gamma Logs (150.0 to 180.0 ft)



299-W15-44 (C3956)

Total Gamma & Dead Time

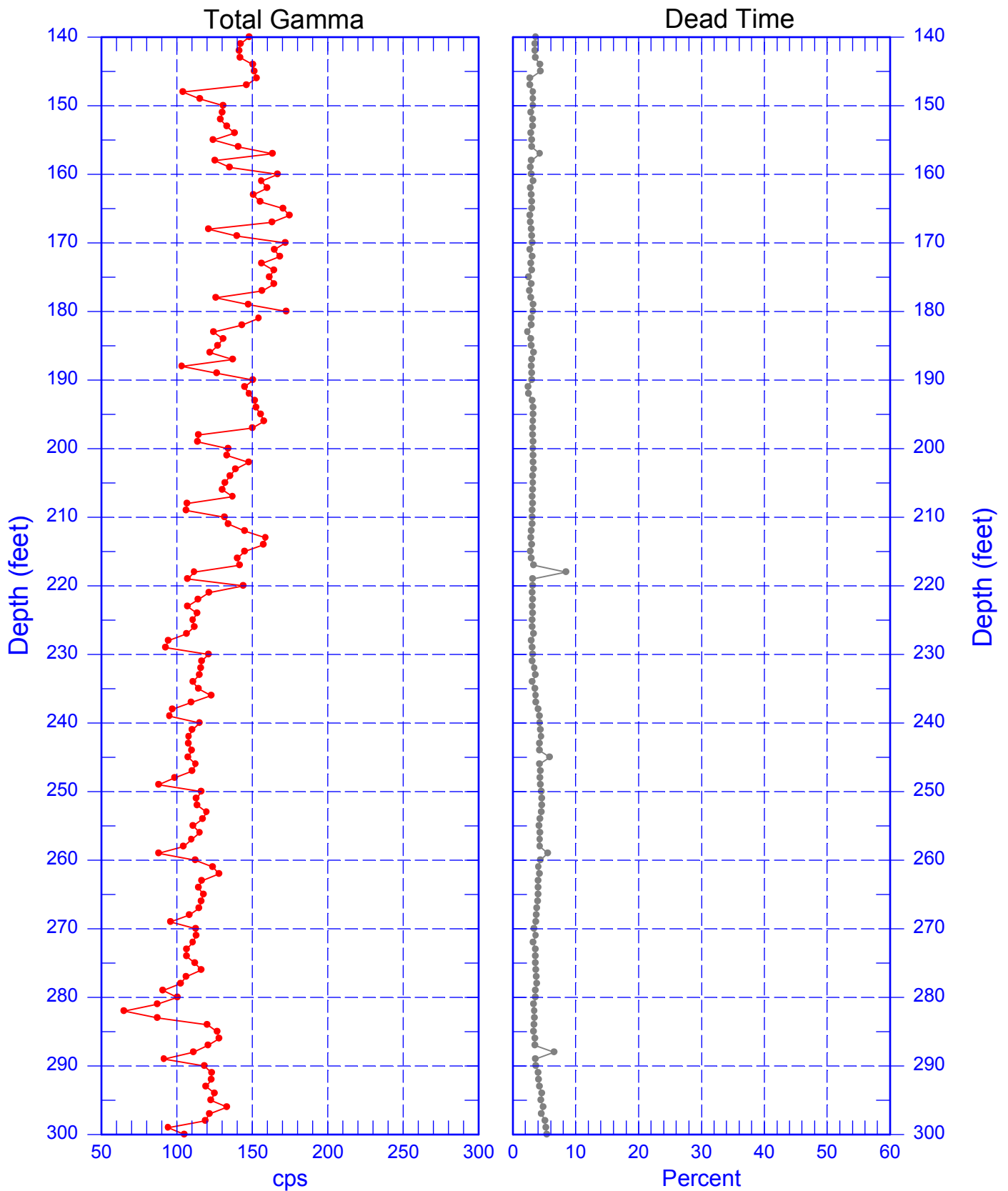


Zero Reference = Ground Surface

Date of Last Logging Run
10/18/2002

299-W15-44 (C3956)

Total Gamma & Dead Time



Zero Reference = Ground Surface

Date of Last Logging Run
10/18/2002

299-W15-44 (C3956)

Total Gamma & Dead Time



Zero Reference = Ground Surface

Date of Last Logging Run
10/18/2002